CLAIMS

1. A blood-vessel-shape measuring apparatus comprising a first array including a plurality of first supersonic-wave elements arranged in one direction; and a second array including a plurality of second supersonic-wave elements arranged in a direction parallel to said one direction, the apparatus measuring a shape of a blood vessel of a living being, based on echo signals detected by the first and second arrays that are placed on a skin of the living being such that each of the first and second arrays is across the blood vessel located under the skin,

the apparatus being characterized by further comprising

a first wall-position calculating means for calculating, based on respective reflection signals detected by the first supersonic-wave elements of the first array, respective positions of respective portions of a wall of the blood vessel that are located right below the first array and correspond to the first supersonic-wave elements;

a second wall-position calculating means for calculating, based on respective echo signals detected by the second supersonic-wave elements of the second array, respective positions of respective portions of the wall of the blood vessel that are located right below the second array and correspond to the second supersonic-wave elements; and

a blood-vessel-shape calculating means for calculating a shape of the blood vessel on an orthogonal section thereof, based on the respective positions of the respective portions of the wall of the blood vessel that correspond to the first supersonic-wave elements and are calculated by the first wall-position calculating means, and the respective positions of the respective portions of the wall of the blood vessel that correspond to the first supersonic-wave elements and are calculated by the second wall-position calculating means.

2. The blood-vessel-shape measuring apparatus according to claim 1, wherein the first wall-position calculating means calculates respective distances to the respective portions of the wall of the blood vessel, based on respective time differences between respective emission signals emitted by the first supersonic-wave elements and the respective reflection signals from the respective portions of the wall, detected by the first

supersonic-wave elements, and determines, based on the calculated respective distances, the respective positions of the respective portions of the wall on a measuring section of the first array, and wherein the second wall-position calculating means calculates respective distances to the respective portions of the wall of the blood vessel, based on respective time differences between respective emission signals emitted by the second supersonic-wave elements and respective reflection signals from the respective portions of the wall, detected by the second supersonic-wave elements, and determines, based on the calculated respective distances, the respective positions of the respective portions of the wall on a measuring section of the second array.

3. The blood-vessel-shape measuring apparatus according to claim 2, wherein the blood-vessel-shape calculating means comprises:

a measuring-section-shape calculating means for calculating, based on the respective positions of the respective portions of the wall of the blood vessel that correspond to the first supersonic-wave elements and are calculated by the first wall-position calculating means, and the respective positions of the respective portions of the wall of the blood vessel that correspond to the second supersonic-wave elements and are calculated by the second wall-position calculating means, a center point, and a major-axis length and/or a minor-axis length, of each of a section of the wall of the blood vessel on the measuring section of the first array and a section of the wall of the blood vessel on the measuring section of the second array;

a center-axis calculating means for calculating a center axis of the blood vessel, based on the respective center points of the respective sections of the wall of the blood vessel on the respective measuring sections of the first and second arrays, calculated by the measuring-section shape calculating means;

a cross-angle calculating means for calculating, based on the center axis of the blood vessel, calculated by the center-axis calculating means, a cross angle at which the orthogonal section of the blood vessel and the measuring section cross each other; and

a correcting means for correcting, based on the cross angle calculated by the cross-angle calculating means, the major-axis length and/or the minor-axis length calculated by the measuring-section-shape

calculating means, into a corrected major-axis length and/or a corrected minor-axis length on the orthogonal section of the blood vessel.

4. The blood-vessel-shape measuring apparatus according to claim 3, wherein the blood-vessel-shape calculating means comprises an orthogonal-section-area calculating means for calculating an area of the section of the blood vessel on the orthogonal section thereof, based on the corrected major-axis length and the corrected minor-axis length provided by the correcting means.

5. A blood-flow-velocity measuring apparatus, characterized by comprising:

a supersonic-wave probe including a first array including a plurality of first supersonic-wave elements arranged in one direction, a second array including a plurality of second supersonic-wave elements arranged in a direction parallel to said one direction, and a Doppler supersonic-wave element, the supersonic-wave probe being worn such that each of the first and second arrays is across a blood vessel located under a skin of a living being and a direction in which the Doppler supersonic-wave element emits a supersonic wave has an acute angle with respect to the blood vessel;

a blood-flow-velocity calculating means for calculating, based on a Doppler reflection wave which is obtained when the Doppler supersonic-wave element emits the supersonic wave toward the blood vessel and which is changed by a Doppler effect based on a velocity of a blood flow in the blood vessel, the velocity of the blood flow;

a first wall-position calculating means for calculating, based on respective reflection signals detected by the first supersonic-wave elements of the first array, respective positions of respective portions of a wall of the blood vessel that are located right below the first array and correspond to the first supersonic-wave elements;

a second wall-position calculating means for calculating, based on respective echo signals detected by the second supersonic-wave elements of the second array, respective positions of respective portions of the wall of the blood vessel that are located right below the second array and correspond to the second supersonic-wave elements;

a center-axis calculating means for calculating, based on the respective positions of the respective portions of the wall of the blood vessel that correspond to the first supersonic-wave elements and are calculated by the first wall-position calculating means, and the respective positions of the respective portions of the wall of the blood vessel that correspond to the second supersonic-wave elements and are calculated by the second wall-position calculating means, respective center points of respective sections of the wall of the blood vessel on the respective measuring sections of the first and second arrays, and calculating a center axis of the blood vessel, based on the respective center points of the respective sections of the wall of the blood vessel on the respective measuring sections of the first and second arrays;

a relative-angle calculating means for calculating an actual relative angle between the center axis of the blood vessel, calculated by the center axis calculating means, and the direction in which the Doppler supersonic-wave element emits the supersonic wave toward the blood vessel; and

a blood-flow-velocity correcting means for correcting, based on the actual relative angle calculated by the relative-angle calculating means, the velocity of the blood flow calculated by the blood-flow-velocity calculating means.

6. A blood-flow-amount measuring apparatus, characterized by comprising:

the blood-flow-velocity measuring apparatus according to claim 5;

a measuring-section-shape calculating means for calculating, based on the respective positions of the respective portions of the wall of the blood vessel that correspond to the first supersonic-wave elements and are calculated by the first wall-position calculating means, and the respective positions of the respective portions of the wall of the blood vessel that correspond to the second supersonic-wave elements and are calculated by the second wall-position calculating means, a center point, and a major-axis length and/or a minor-axis length, of each of a section of the wall of the blood vessel on the measuring section of the first array and a section of the wall of the blood vessel on the measuring section of the second array;

a cross-angle calculating means for calculating, based on the center axis of the blood vessel, calculated by the center-axis calculating means, a cross angle at which the orthogonal section of the blood vessel and the measuring section cross each other;

a correcting means for correcting, based on the cross angle calculated by the cross-angle calculating means, the major-axis length and/or the minor-axis length calculated by the measuring-section-shape calculating means, into a corrected major-axis length and/or a corrected minor-axis length on the orthogonal section of the blood vessel;

an orthogonal-section-area calculating means for calculating an area of the section of the blood vessel on the orthogonal section thereof, based on the corrected major-axis length and the corrected minor-axis length provided by the correcting means; and

a blood-flow-amount calculating means for calculating an amount of the blood flow in the blood vessel, based on the area of the section of the blood vessel on the orthogonal section thereof calculated by the orthogonal-section-area calculating means, and the velocity of the blood flow corrected by the blood-flow-velocity correcting means.